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ABSTRACT

Neuroscientific evidence for the underlying neuronal activity in the cerebral cortex for psychological states points to the need for an alternative physiological hypothesis for the construct of self concept. Evidence from neuroscience and hereditability studies leads to the conclusion that genetic forces may be clearly at work in the perception of self. The primary hypothesis of this study is that adolescent self concept is a neuroscientific set of developmental processes predominately governed by genetic inheritance. Copies of a 1-page survey were administered to high school students in China, Russia, Indian adolescents in Montana, and a sample of white adolescents This report comparing adolescents from China, Kazakhstan, and America youth suggests that environmental influences do not appear to play the predominant role. It concludes that researchers need to acknowledge in citations and conclusions the pervasive evidence for the predominance of the genetic influence in future self-concept studies. (Contains 184 references.) (JDM)

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ADOLESCENT SELF-CONCEPT AMONG CHINESE, KAZAKH, AMERICAN AND AMERICAN INDIANS

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ADOLESCENT SELF-CONCEPT AMONG CHINESE, KAZAKH, AMERICAN AND AMERICAN INDIANS

ABSTRACT

Evidence supporting neuroscientific and genetic theories of adolescent self-concept as an alternative etiology for cognitive theories of self-concept has emerged. The cognitive neuroscientific literature suggests that self-concept is a variant of consciousness differentiated into three components: proto-self, core self and autobiographical self, all largely governed by heritability factors according to research from behavioral genetics. Evidence also reveals a physiological bases for similar constructs. This paper reports on data collected from American Indian, Kazakh, American and Chinese adolescents revealing a uniformity among perceptions of the self on various dimensions, including personal identity, relations with others and academic performance.

ADOLESENT SELF-CONCEPT AMONG CHINESE, KAZAKH AND AMERICAN INDIANS

Emerging evidence from brain sciences and heritability studies supports an alternative etiology for re-conceptualizing and researching adolescent self-concept and its correlations with other personality, cognitive and schooling variables. Neuroscientific investigations have concluded that the cerebral cortex is the center of psychological states and that phenotypical genetic differences contribute to measures of the environment (Plomin, 1993). Self-concept in this paper is assumed to be a assembled set of neural correlates governed principally by genetic forces which converge during adolescence and promote development. It is further assumed that self-concept is complementary with, and inseparable from, consciousness, differentiated into a proto, or unconscious self, core consciousness of self, and autobiographical self (Damasio, 1999).

The Neuroscientific Basis for Self-Concept

Cognitive neuroscientists (Kosslyn & Koenig, 1992), evolutionary psychologists (Barkow et al., 1992, Wright, 1994) and genetic behavioralists (Plomin, 1988, 1993) assume that psychological states are physiological processes in the brain and not separate mental entities. Psychological constructs unquestionably have physiological foundations in the brain, as James (1892) noted more than a century ago. Even Kohler (1969) pointed out: "Psychological facts and the underlying events in the brain resemble each other in all their structural characteristics" (Kohler, 1969).

The central nervous system culminating in the brain is the control center for all neural networks regulating consciousness, memory, thought, language, imagery and behavior (D'Esposito, 1995, Farrah, 1995, Gazzaniga, 1995a, Barrinaga, 1996, 1997), all governed by genetic development (Plomin, 1993). Neural correlates in the brain have been found for memory (Squire, 1986, Goldman-Rakic, 1992, Moscovitch, 1995, Eichenbaum, 1997, Shadmehr & Holcolm, 1997, Vardha-Khadem, 1997), learning (Kandel, 1992), language and speech (Hickok, 1996), writing (Rapp, 1997), and disorders such as dyslexia (Shaywitz, 1996) and autism (Frith, 1993, Lainhart, 1997). Moscovitch (1995) has proposed a model for what he calls "recovered consciousness" in memory attached to neuronal signals or markers associated with specific memories. Neural correlates have been discovered for category-specific knowledge (Martin, 1996), and for mate selection

based on musical ability (Sluming & Manning, 2000). The mechanisms producing all types of cognition and consciousness can be fully explained by brain science (Bickel et al., 2000).

And what is true of cognitive states has also been shown to be true of affective states. Gazzaniga (1995b) has suggested that consciousness is reflective of specialized systems in the affective domain evolved to enable human cognitive processes to function. Kagan (1989) writes about his research with children and notes that psychological states like irritability and shyness have thresholds in the limbic system (Kagan, 1989, p. 18). Similarly, Jacobs and Synder (1996) found that frontal brain asymmetry can have an influence on affective behavior in men. Using electroencephalogram measurements, they found links between individual differences in basic emotions and concluded that frontal brain asymmetry is a marker for affective style.

The general conclusion from the neurosciences is that both emotions and core self-concept require the same neural substrates, and discrete systems relate to different emotional patterns. Though there is no central place for processing emotions, the neuronal connections are located largely in the subcortical area of the brain stem, hypothalamus, basal forebrain and amygdala (Bloom, 1995, Rolls, 1995, Halgren & Marinkovic, 1995, Damasio, 1999).

A wide range of behaviors linked to brain anomalies only bolsters the claim for a neuroscientific basis to behavior and cognitive states. Gottschalk (1992) discovered that violent criminals have an unusually high amount of manganese in their hair and a relationship between hair chemistry and violent behavior related to the Self. There is mounting evidence that schizophrenia, manic depressions, and other psychiatric disorders have a physiological origin. Whether or not anyone will uncover specific genes related to intelligence, for example, or other specific human mental traits or abilities (not just for diseases) is a matter of questionable speculation, although that is now an active research topic in medicine and with the Human Genome Project, but rarely in education and psychology (Horgan, 1993, Petrill & Wilkerson, 2000). It is unlikely that any single gene controls any individual trait (Plomin, 1993).

The integration of cognitive functions in the cerebral cortex was first proposed by Lashley (Bruce, 1991). Traits bunched together in neuron ensembles are governed by what Hebb (1949) called "cell assemblies," and Damasio (1999) characterizes as "convergent zones."

Evidence from Cellular Biology

Some of the most compelling neuroscientific evidence has emerged from research in cellular biology (Cairns-Smith, 1996). Scientists in cellular immunology define the Self as the immune system which makes life possible. A malfunction of the immune system, such as HIV, causes death and consequently the complete loss of Self. Lymphocyes, the white blood cells, attack and destroy that which it does not recognize as Self. The great mystery and question is: How does the whole immune system recognize the potentially infinite number of bacteria and viruses and decide which are a part of the organism and which are not? (Nossal, 1993, p. 54). A person's body will readily reject a skin graft from an unrelated donor person, but easily accept a skin graft from another part of its own body (Marrack & Kappler, 1993, p. 83). Nossal (1993) writes: "Amid all the complex operations of the immune defenses, it is utterly crucial that lymphocytes remain consistently benign toward the body's own cells, commonly referred to as the self, while reacting aggressively to those that it recognizes as foreign, or nonself" (1993, p. 55)

Von Boehmer (1991) and associates report that cellular tissues in the organism can distinguish between similar tissues and cells that are genetically identical from others which are genetically foreign and therefore invader cells. In various ways, unknown to researchers at the present time, selected cells in the immune system are able to recognize genetically identical cells, and when it finds a "nonself" cell, attack and destroy it, and thus it fends off disease. Von Boehmer concludes: "Thus, the immune system learns to distinguish self from nonself by screening lymphocytes: the useful are selected, the useless are neglected, and the harmful are rejected" (Von Boehmer, 1991, p. 80).

If we accept that self-concept has a neurological basis, where is it located in the brain? One theory is that consciousness and the recognition of personal identity is located in or near the thalmus, a subcortical part of the lower brain in the parietal lobes (Bogen, 1994). Small lesions in this area seem to impair conscious activity, whereas large lesions elsewhere in the brain, for example the frontal lobes, do not seem significantly to effect consciousness. Thus, consciousness, or the perception of personal identity and self-concept, could be located in the parietal lobes. What is clear is that brain nuclei which manage the life process are contiguous to, and connected with, nuclei associated with attentive behavior, emotion and consciousness

of self (Damasio, 1999).

Identified individuals with neurological disorders, like prosopagniacs, persons who are unable to recognize faces, a key ingredient in awareness of others and Self, have damage to the inferior temporal lobe. People with Capgras syndrome believe that individuals they recognize have been replaced by impostors or alien spirits (Hauser, 2000), and they have specific damage to the amygdala. Severe autistics, who have damage to the cerebellum, live in a bubble world of social isolation where the distinction between the world and the Self is indistinct. Damasio (1999) concludes from his studies of impaired consciousness that even victims of Alzheimer's disease are first impaired in what he calls extended consciousness and eventually core consciousness. Individuals with neurological impairments, such as comas, persistent vegetative states, deep sleep and anesthesia have disruptions in core consciousness with varying degrees of wakefulness and attention behaviors (Gott, 1994, Damasio, 1999).

Moreover, the pharmacological revolution has reaped benefits for a generation of prescribed anti-depressant drug users. Prozac, with over 17 million users, and Zoloft, have changed peoples' personalities beneficially by equalizing chemical imbalances in the brain. These drugs, the so-called SSRIs (selective serotonin re-uptake inhibitors), correct imbalances in serotonin in the body. Serotonin is a natural ingredient which is believed to alter mood.

Some researchers see a merger of the two sciences of cognition and the neurosciences and visualize the results of investigations in the brain serving as substrata of mental processes (Kandel & Hawkins, 1992). Kandel and Hawkins (1992) admit that eventually a broad biological unification of understanding and theory might result in a "demystification of mental process and position their study [cognitive psychology] squarely within the evolutionary framework of biology" (1992, p. 86). Some researchers call the mental processes "intangible." (Gershon and Rieder, 1992). A scientific study of the brain has not seemed to have seriously challenged the concepts which have defined the psychology of mind for over two millennia.

The Three Faces of the Self

Damasio (1999) has provided a new theory based on his brain operations as a surgeon. Damasio proposes that there are three selves: a Proto-Self, a Core Self, and an Autobiographical Self. I suggest that these distinctions are also true of the perceptions of self-concept or personal identity and all its various cognitive components.

Adolescent Self-Concept

The Proto-Self is the nonconscious forerunner to consciousness and consists of neural patterns in the lower brain, such as the brain stem, the hypothalamus, the basal forebrain, and the somatosensory cortices. In the Proto-Self there is no perception and no knowledge and we are not conscious even of its existence.

The Core Self, which changes based on new experiences and results in enhanced wakefulness and focused attention, is hypothetically located in higher regions of the brain, in the superior colluculi, the cingulate cortices and the thalamus. Together, these form a part of the singularity of core consciousness or awareness. The Core Self is not necessarily regulated by language.

The Autobiographical Self, or extended consciousness, is the record of life experiences layered in memory.

Like Plato for the soul and Freud for the personality, Damasio (1999) has conceptually divided the perception of personal identity into a tripartite arrangement. His argument is compelling since it is based on his studies of victims of a variety of serious neurological impairments where specific cognitive functions can be observed, or their absence. The new technology for identifying where in the cerebral cortex specific functions relating to levels of consciousness occur (Positron Emission Tomography, or the PET scan, Electo-encephalogram, or EEG, Echo-Planar Imagining or EPI, Magnetic Resonance Imaging, or MRI, and Magnetoencephalography) adds a level of discrimination unthinkable even just a few years ago.

Cumulatively, the neuroscientific evidence is formidable in making the case that self-concept stems from a biological basis in cellular life. Granted this, the following question is, To what degree is the development of self-concept governed by genes?

Genetic Behavioral Theory and Studies

The physiology of genetic inheritances profoundly influence psychological composition (Cairns-Smith, 1996). Genes drive experience and help the organism organize experiences. According to Scarr & Carter-Saltzman (1982) parents can have important nurturing effects on children's motivation and self-esteem, but not on their overall personality, attitudes, interests, or intelligence, all of which are determined by genes.

Scarr (1983a) recorded evidence of the biological origin of individual psychological traits. She tested whether inter-racial children reared by White families perform as well on IQ and other tests as other adopted

children reared in the same environment. She found that individual differences were related more to biological causes and that there was strong evidence of genetic variability for all psychological aspects investigated. She found little evidence that accounted for environmental influences.

A new review points to a behavioral and genetic perspective between intelligence and achievement (Petrill & Wilkerson, 2000) which has implications for adolescent self-concept research. The genetic behavioral model suggests that individual differences, such as intelligence, achievement or self-concept, can be shaped by both genetic and environmental factors. The un-answered question is, How much do genes influence the stability of any form of multifaceted and hierarchical self-concept, or differentiate between the core self and the autobiographical self?

Moreover, the genetic influences on intelligence are well established and statistically significant, tending to become more predominant over time and age (Petrill & Wilkerson, 2000). Bouchard et al. (1990) concluded that over 70% of intelligence is attributable to genetic inheritances. Fewer studies examine the heritability of academic achievement (Marsh, 1988, 1993) and none explore the heritability of self-concept. Empirical researchers believe that genes do play a role in all human behavior but that the environment, the culture, or schooling variables, shape and drive the correlation (Walkins & Regmi, 2000).

Even in the field of organizational behavior, according to Arvey (1989), research suggests that there are genetic, and not just environmental, components to such matters as job satisfaction. Arvey has documented this phenomenon: "It seems reasonable that genetic factors might influence the manner in which individuals respond to their work contexts" (Arvey, 1989, p. 187).

Marsh (1988, 1993, 1995) has demonstrated the distinction between levels of academic self-concept separated in general by the schooling disciplines. Hay et al. (2000) concluded that children with low academic achievement on one domain tend to reduce their academic self-concept in another to maintain a consistently low academic self-concept. Assuming that self-concept and its various components like academic self-concept is influenced by both genetic heritability and environmental determinants, the main questions are: to what degree do genes determine the functioning of how an individual perceives different aspects of identity, like academic self-concept, and how much does genetic development influence behavioral

responses of the self to the environment?

Twins reared apart are the most valuable research tools for studying differences between heritabilty traits compared to environmental differences. Bouchard (1988, 1990), who has been studying examples of twins reared apart since 1979, from over 100 cases concluded that genes account for about 70% of the variation in measures of IQ. The similarities of responses and behaviors from identical twins could not be explained by any similarity in environments (Bouchard, 1990, p. 223).

Other results of self-report questionnaires from identical and fraternal twins group around correlations of .50 and .30 respectively, and the correlations for identical twins are consistently greater than for fraternal twins on all measures (Plomin, 1986). A wide range of behaviors and personality traits have been found to have high rates of concordance between identical twins, even more than for fraternal twins (Wright, 1995).

Environmental factors, both family and extra-familial environments, clearly have a measurable impact on behavior. What is new is accumulated evidence that genetic factors contribute to environmental measures (Plomin, 1993). Can this be true of perceptions adolescents have of themselves? Genetic forces are clearly at work in the individual perceptions. Rowe has found that genetic factors play a role in children's perceptions of parenting (Rowe, 1981). Similar perceptions of parents of their own parenting skills reveal positive signs of genetic effects (Plomin, 1993). Ratings of characteristics of adolescents' peer groups have yielded strong evidence for genetic tendencies (Plomin, 1993). Plomin (1993) has demonstrated that measures of the environment contain genetic traces because individuals also choose their environments, by choosing who they associate with most of the time, within a family or schooling context.

Hypothesis

A combined genes and environment hypothesis would suggest that self-concept and related psychological constructs and variables have correlations because of mutual interaction and overlap (Plomin, 1993, Petrill & Wilkerson, 2000). Bickel et al. (2000) have discovered sequential patterns for conscious processes in the brain's neural systems. Such neuroscientific evidence for the underlying neuronal activity in the cerebral cortex for psychological states, dispositions, and cognitive activities like language comprehension and production (Bickel et al, 2000), points to the need for an alternative physiological hypothesis for the construct of self-concept.

Damasio's (1999) proposal of three selves is just one such theory.

The idea of self-concept clearly may not be the same for adults as it is for adolescents, or indeed for one individual across the life span (Bryne, 1966, Plomin, 1986). It may also be wrong to conclude that adolescent self-concept is simply an immature form of adult self-concept. Nevertheless, the accumulation of evidence from the neurosciences and heritability studies leads to the conclusion that genetic forces may be clearly at work in the perception of the Self.

Environmental conditions are the traditional citations for the positive or negative perceptions children and adolescents have of their personal identity, some combination of home background, parental aspirations, social class, achievement motivation and the like.

The cultural component has been repeatedly cited as a probable factor in influencing self-concept (Marsh, 1993, Chan, 2000, Walkins & Regmi, 2000). For example, Lundberg et al. (2000) conclude that confidence has a cultural component and, based on individualism, non-westerners adopt a more positive impression of themselves. Other researchers equate the search for identity solely within the postmodern experience, in a social constructivist context, and maintain that "identities are neither acquired or bestowed, but are actively constructed by the individual through social relations and social participation" (Parmenter, et al., 2000). No evidence is cited for this ideological premise. Yet except in the neuroscientific literature rarely is the genetic contribution even noted as a probable influence in cognitive processes.

Hence, the primary hypothesis of this study is that adolescent self-concept is a neuroscientific set of developmental processes governed predominantly, but not exclusively, by genetic inheritances. It is also assumed that adolescent self-concept is based on a theoretical set of three selves: an unconscious proto-self, a conscious self, and an autobiographical self composed largely of layered memories. Responses on a self-reporting survey instrument cannot reliably separate these theoretical distinctions among parts of the self, and hence it is assumed that they operate in tandem.

Method and Procedures

A 36 item Likert-like survey instrument, modified from similar instruments like Rosenberg's (1989), and designed for adolescents, was developed to test for self-reportings on self-concept. The form included

perceptions about the body, attitude, interest, relations with others, and perceptions of personal and academic identity. Coopersmith's Self Esteem Inventory is primarily for children, and Chan (2000) has used it in a recent cross-cultural comparison, but it is considered unsatisfactory for adolescents. The Tennessee Self-Concept Scale (TSCS) is widely used, but its purpose is primarily clinical and it is too lengthy. Subsequently, the instrument was validated in 1989 with the Tennessee Self-Concept Scale. Ezeilo (1982) found the TSCS was a useful tool for studying Nigerian youth, thereby lending credibility to its cross-cultural acceptance.

The intent has been to control for cross-cultural factors by conducting an international survey of adolescents from varied cultural and minority backgrounds throughout the world. Walkins & Regmi (2000) have argued that individual tests of self-esteem may not be appropriate for non-westerners and plead for culturally appropriate models, but like others, use self-esteem and self-concept interchangeably, thereby confounding clarity and construct validity. Adolescents in this study have been sampled thus far from America, Cyprus, Cameroon, China, England, Kazakhstan, and South Africa. The hypothesis is that if results are relatively stable from different countries and continents, ethnicities and cultures, given widely differing environments, then it is reasonable to conclude that perceptions of adolescent self-concept are influenced by neuroscientific processes and heritability traits.

The limitations of measuring various social and cognitive traits by means of self-report instruments have been well documented (Kahne, 1996, Bryne, 1996). For one thing, it isn't clear if students are responding to actual beliefs or those they think others should have of them. Anderson and Hughes (1989) point out that new instruments are needed: "One primary focus of future research in the area of self-esteem and parenting should be to develop better measurement instruments" (1989, p. 464).

I have relied on several international colleagues for translation, validation in translation, and administration of the instrument which has been translated and re-translated to show its validity, from English into Spanish, Africaans, Russian and Chinese. Results of this study come from the Russian translation of the instrument for the Kazakh adolescents, Chinese for the Han and English for the American Indians. Translations into the vernacular constitutes an additional lowering of confidence in the construct, and thus could weaken construct validity (Messick, 1995). It will not be possible to know with high confidence the accuracy of the translations, although they

have been subjected to more than one cross-check, or whether or not evidence of the trait, in this case self-reports of the self-concept, might be construed differently in different languages.

The 36 items on the survey instrument ask respondents to answer on a five point Likert-like semantic differential scale to positively-worded statements. These statements, for simplicity in reporting, have been in the form of grouped variables. Tachakhori & Kennedy (1993) have reported that applications of self-concept should be done on components rather than overall measures of self construct. Composite variables also facilitate interpretation of the data. These grouped variables are: 1) body; 2) attitude; 3) interest; 4) relations with others; 5) perception of Self; 6) identity; and 7) general academic self-concept. Tables show the means and standard deviations of these grouped variables as an aggregate and between genders. According to Dyer (1979) such "ordered categories" fall between nominal and ordinal measurements.

Copies of the one-page survey instrument translated into Mandarin Chinese were distributed in six different cities to 603 randomly selected high school students aged 13 to 18 in The People's People of China. The Russian translation served for the 105 Kazakh students in the capitol city in Kazakhstan, Almaty. About 75 American Indian adolescents from Montana took the survey in English. The adolescent white population sample has been collected from a data source of over 2,000 junior and senior high school students.

Discussion

Emerging neuroscientific evidence shows a strong correlation of psychological constructs with identifiable physiological processes in the brain and with genetic heritability. Neuropsychological evidence is consistent with a model of consciousness in integrated representations dispersed across the cerebral cortex. When researchers discover compelling physical evidence of psychological states in the brain, then confirmation of a neuroscientific theory is closer to acceptance. Although many researchers may ignore, or just neglect, genetic relevance, this is likely because of a lack of instruments and access to necessary populations.

If it can be demonstrated that there is relative uniformity among international indigenous adolescents on data collected from a validated survey instrument, a random sample of indigenous adolescents, then it is reasonable to conclude that the self-reported perceptions of adolescent

self-concept, together with neuroscientific processes and other developmental factors, is not just the result of environmental differences.

A study of adolescent self-concept among Han majority and Korean and Mongolian minority Chinese adolescents found little variation on perceptions of personal identity, relations with others and academic achievement (Sharpes & Wang, 1997b). A study comparing American Hispanic and non-Hispanic adolescents with White and Black adolescents in South Africa yielded similar results (Sharpes, 1992). This report comparing indigenous adolescents from China, Kazakhstan and American Indian youth found similar uniformity, which suggests environmental influences do not appear to play the predominant role at least on reporting instruments.

The tables list the seven composite and grouped variables of "body," "attitude," "interest," "relations," "perception of self," "identity," and "academic" among selected indigenous adolescents of China, Kazakhstan and American Indians from North America. The second set of three tables (Tables IV through VI) compares the Han Chinese and Kazakh adolescents with a larger sample size of White American adolescents. The grand mean score of White Americans at 3.70 is identical with the grand mean score of American Indians. The main comparative group difference is that the Han, the indigenous peoples of China, who have lower grand mean scores. There is greater similarity among the three groups in academic self-concept. The same disparate comparative mean scores exist when one omits the American Indian sample and substitutes the White American sample, which is also the largest population group.

The variability within an indigenous group is greater than the variability between the population groups. Among American Indian youth, for example, this disparity ranges from a high mean of 4.35 for the composite variable of "relations," to a low mean on the perception of the Self towards "body" at 3.20, a disparity that is much greater at 2.73 among females than for males at 3.49.

There are uniformly high mean scores are for the composite variable "academic." Though the survey instrument has a tick location for whether an adolescent is in school or not--and many sampled in an earlier study in Cameroon were non-school adolescents--all the adolescents in this report were in formal schooling.

Factor analysis was not applied because of insufficient sample sizes. But, though sample sizes are limited, the trend points towards approximate uniformity of population variances between groups in non-shared

environments. Variation within indigenous ethnic groups, when compared to other groups in widely differing parts of the world, has minimal variation. Even weak quantitative analyses which produces similar effects across international boundaries and ethnic groups would tend to point to similarities in human development.

How self-concept correlates with intelligence, academic achievement, gender or age can help explain the variance between these constructs. For example, a correlation of .50 means that 75% of the variance in one variable, like academic self-concept, is not shared with another variable like perception of personal identity or academic achievement. Studies generally factor analyze correlations between general self-concept with math and verbal achievement levels. But variation in any human quality is not just an error but an evolutionary, genotypical necessity. And group differences are not simply variances in means, but distributions that have at least 95% overlap or more.

The most immediate cause for concern among researchers who ignore genetic influences in self-concept is the possibility that reported variances are not attributable to cognitive or environmental influences at all, but to un-measured genetic factors. For example, generalizability theory does not account for development concerns but only the sources of error among individual scores, or facets, or between relative and absolute interpretations of behavioral measurements (Shavelson & Webb, 1991). Generalizability remains a powerful tool for examining the dependability of behavioral measurements, but not necessarily for exploring the effects of genes on development or behavior.

Researchers need to acknowledge in citations and conclusions the pervasive evidence for a predominance of the genetic influence in future self-concept studies, as they generally do with disclaimers about errors in the limitations of sample size, instrument use and generalizability.

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